Co-creating an ICT Artefact with Elderly Rural Women in Mafarafara: a Social Structuration Account[1]

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Abstract. In South Africa, elderly rural women is the most socio-economically disadvantaged population group: their age, gender and rural location all contribute to their disempowerment. For this reason, an ICT4D project was undertaken by the CSIR with the aim of supporting elderly rural women in their livelihood activities. An ICT artefact was established and implemented in a women's Community Centre in Mafarafara, a remote rural village in the Limpopo province of South Africa. The ICT artefact was a rugged information kiosk based on Digital Doorway technology, and was populated with information to assist the women in their farming activities. As part of the women's empowerment, they were involved as co-creators of the ICT artefact and its contents. The study employed a Design Science Research Methodology (DSRM). During the project the strong influence of the local social dynamics on the design of the artefact became apparent. To this end, Giddens' structuration theory was incorporated in the study, to make visible the social dynamics that influenced and in turn were influenced by the design process. In this paper, concepts from structuration theory are applied to qualitative data from the Mafarafara interviews and site visit reports. The value of using structuration theory alongside DSRM to acknowledge the social nature of design is demonstrated. Structuration theory also provides a means to show how the participating women were empowered.

Keywords: Elderly Rural Women, Structuration Theory, Digital Doorway, Rural Development, Design Science Research.

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1 Introduction

"Women in South Africa are still the face of poverty, inequality and unemployment. Despite the gains made in women's social and economic standing since 1994 … these challenges still persist" [1].

Elderly rural women (ERW) are the most disadvantaged population group in South Africa [1-3]. They are mostly illiterate and poorly educated; isolated and confined to their communities; subject to discriminatory customary laws, persisting patriarchal attitudes and prejudice; have access to severely limited resources and are marginalized due to the lack of initiatives aimed at their upliftment and empowerment [3, 4]. Socio-cultural norms, values and practices which relegate women to the lowest position in society are still firmly entrenched in rural communities and are adhered to by the elderly and traditional authority structures [5]. The literacy levels amongst elderly black women in particular are significantly lower than their younger counterparts, who received their education after the end of apartheid [3, 6, 7].

Intentionally placing the focus of development projects on the empowerment of women, is important for a number of reasons. Firstly, the economic upliftment of women can contribute to inclusive and sustainable development [8]. Secondly, addressing the disparate development outcomes between men and women, can have a positive influence on food security and household wellbeing [9, 10].

There is wide-spread acceptance that ICT in its various forms can be instrumental in addressing gender inequalities and enabling women to empower themselves socially and economically [11-16]. However, for ICT4D projects to succeed researchers and donors must recognise the agency of women in developing communities; their "experiences, options, choices, dreams, and perspectives" (Nzegwu in [11]).

The Mafarafara ICT4D project was initiated with the aim of supporting ERW from a disadvantaged community by means of an ICT artefact to enable and support their livelihood activities [17]. This paper reports on the study that was conducted to design and develop the ICT artefact, and that involved the women of Mafarafara as co-creators of the ICT artefact. The study was executed using a Design Science Research Methodology (DSRM). While the empirical project was underway, it became clear that the social dynamics within the local community as well as the dynamics between the users and the CSIR researchers had a determining influence on the design of the ICT artefact. To this end, Giddens' structuration theory [18] was used on the case data to make visible the influence of the social dynamics on the design process. This paper was written to demonstrate how structuration theory was applied in the study.

The paper is structured as follows. In the next section, the empirical and project contexts are presented. Thereafter, the research methodology is presented. This is followed by an analysis of the qualitative data collected during the empirical study, to demonstrate the value of using structuration theory in this context. The paper concludes with a discussion of the findings and implications for future research.

2 Project and Empirical Context: The ICT Artefact

This study forms part of the Digital Doorway project that was initiated in 2002 between the CSIR and the Department of Science and Technology (DST). The DD project, as it was coined, formed part of the Government of South Africa's strategic mandate for ICT development. The project focus was to allow especially the marginalised people in resource deprived areas of South Africa's deep rural areas, to get access to ICT and to enhance their digital literacy skills [19].

The Hole-in-the-Wall project in India was the inspiration behind the design. The assumption was that if you provided a robust (unbreakable) computer-type device to people they would use it and teach one another to improve their computer literacy skills and they would get access to information that was previously only found in books in the library [20]. Accordingly, the DD is a kiosk with four screens or terminals, with a client/fileserver PC and two diskless clients designed for a low maintenance solution in order to deploy it outside for public/community access [21]. With the current DD (of which the ICT artefact in this study is a special instance), a user can create a personal account and enter the information (age, gender, home language) This data, as well as specific application usage is hosted on a server. A webcam allows users to create a personalised profile and they receive incentives for logins. This ensures the validation of demographic data [20]. The DD project was seen as a success as it resulted in more than expected evidence of skills gained and use of information in rural areas of South Africa.

This study arose as a result of a decision by the CSIR to propose a project focusing on ICTs, women and agriculture that was informed by the high priority the South African government affords these focus areas. Therefore the DD (selected based to its proven suitability to resource deprived rural environments) was modified with the active participation of the elderly women in Mafarafara to produce an ICT artefact co-created uniquely to suit their requirements.

2.1 Rationale for the co-creation approach that was followed

Ramaswamy and Ozcan [22] postulate that the real value of creation does not only apply to co-creating artefacts, but rather lies with the value that the new co-designed artefact within their own contexts can have for participants, based on their involvement in their own networks. This is particularly relevant for this study, as the ERW co-created an ICT artefact based on their needs and gain value out of this co-creation process as it improves the quality of their lives. In South Africa, there is a need for innovation in developing contexts, however the involvement of the government is not very prominent in promoting this [23]. That is why some ICT4D studies do not acknowledge the innovation that takes place at an individual level as they develop products that are rooted in a specific socio-cultural context [24]. The specific co-creation process of Suryana, Mayangsari and Novani [25], was applied here because it indicates that for co-creation to have real value the co-creation process steps should be: *co-experience, co-definition, co-elevation, and co-development*. Ramaswamy and Ozcan [22] concur that the value of design lies in the interactions, where agencies of actors and structuring

organisations operate in a networked structure of system–environment interactions. They bridge the theory–practice divide, where interactive artefacts connect new value creational opportunities with resources.

2.2 The project in Mafarafara

The DD was installed at the Setsong Community Centre which was the gathering place for the older women of Mafarafara. The women derived their income from pension, sewing and low scale farming.

Fig. 1 shows the ICT artefact being used by the ERW in the Community Centre:

Fig. 1. Women using the ICT artefact in Mafarafara

3 Research Methodology

In this section, the study's research philosophy, strategy, data collection and analysis as well as theoretical framework are discussed.

A pragmatist research philosophy was adopted. Pragmatists are concerned with solutions to problems that work, and knowledge is viewed as a way to improve the world [26, 27]. This view aligns well with the Design Science Research (DSR) aim of changing the current situation into a desired one [28]. In fact, it is contended that DSR is essentially pragmatic in nature [29].

DSR was used as the research strategy. DSR is a creative problem solving methodology that focuses on the production of innovative and new knowledge in order to solve a problem. DSR researchers are concerned with relevance and making an impact. DSR is assessed by its pragmatic validity, practical relevance as well as utility [30-32]. DSR's emphasis on making a practical difference makes it suitable to use in an ICT4D context [33]. Of the several Design Science Research Methodologies (DSRM) available, the methodology of Peffers et al. [34] was used to guide and execute this study.

Peffers et al. [34] regard DSR as an iterative problem solving process involving the following six steps. For each step, its application to the Mafarafara ICT4D study is indicated:

1. **Problem identification and motivation:** This study aimed to address the disadvantaged position of elderly rural women in the South African context;
2. **Definition of the objectives for a solution:** The objectives of the study were to arrive at an ICT artefact that would enhance the livelihoods of elderly rural women, and secondly to develop a framework for co-creation of such an artefact;
3. **Design and development:** To design and develop improved versions of the artefact over three project phases as shown in Figure 3, with multiple iterations during phase 2 where a case study was applied. Mafarafara was selected as the case and the ERW were participants that co-created the ICT Artefact. Structuration theory was applied here as the lens to analyze and comprehend the social dynamics of the community and the value that was gained through the co-creation process;
4. **Demonstration:** The ICT artefact was demonstrated in the Mafarafara case setting;
5. **Evaluation:** The successive iterations of the ICT artefact was evaluated by the rural women of Mafarafara, while a co-creation framework was simultaneously developed and later evaluated by a panel of experts (the description of this framework is outside of the scope of this paper); and
6. **Communication:** The findings of the project were communicated through project reports, academic publications as well as a PhD thesis.

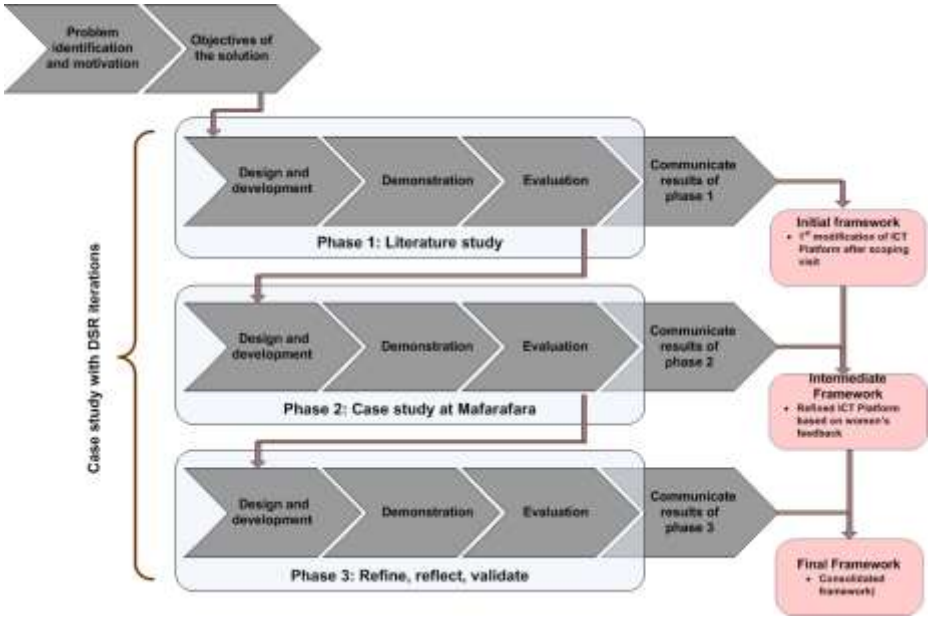

Fig. 2. Design Science Research Methodology as applied in this study (Adapted from [34])

For the purpose of this paper, the data collected during Phase 2 (see **Fig. 2**) will be discussed as it occurred in the form of interviews, focus groups and site visit reports. Interviews and focus groups were conducted in the local language namely Sepedi and translated, transcribed and coded thereafter. The site visit reports were drafted in English. Most of the field work was done by researchers from CSIR who were fluent in both Sepedi and English. Data analysis occurred while the study was ongoing, so that it could inform the improvement of the ICT artefact. Feedback was received during interviews about the way the women experienced the ICT artefact and what further improvements they recommended.

3.1 Theoretical Framework

While the CSIR research team was involved with data collection, the authors realized the determining influence of the local social context on the design of the artefact. It was more complex than just understanding the local setting as a passive or static influence; there were community dynamics that had to be continuously understood and taken into account, even though much of it was unstated. In addition, the CSIR research team contributed to these dynamics in planned as well as unanticipated ways. The social dynamics had such a strong influence on the design process (which in turn influenced the social context) that an instrument was required to investigate the influence of the social dynamics on the project. To this end, structuration theory [18] was identified as an appropriate instrument for making visible the social dynamics.

Giddens developed structuration theory as a means to synthesize the mutual influences of social agency and social structure, where social structure refers to the tacit and unstated "social rules" that guide our behavior [18]. According to structuration theory, social structure and agency are mutually constituted:

"Human agents draw on social structures in their actions, and at the same time these actions serve to produce and reproduce social structure."[18]:129

"Agency" refers to our continuous stream of daily actions, rather than discrete events [35]. Action refers to the capability to make a difference, and hence to exercise power. Social structure consists of rules and resources. Rules can be sense-making or normative in nature (how to do things, or how we are expected to do things). Resources is what gives us social power, and can take the form of authoritative or allocative resources. Authoritative resources refer to the capability of having command over people – whether because of one's position or because of leadership traits. Allocative resources refer to the capability to draw upon material things in order to have command over our environment and hence social power. The resource is not about the "thing" itself, but about our ability to use it in a certain way [36]. Giddens' structuration theory can be summarized by the dimensions of the duality of structure shown in **Fig. 3** [18],[35]. The dimensions of the duality of structure is the analytical framework that is most often used by researchers as a basis for applying structuration theory [37], and it will accordingly be used in this study.

Structuration process	**SIGNIFICATION**	**DOMINATION**	**LEGITIMATION**
Structure element	Interpretive rules	Resources (authoritative and allocative)	Normative rules
	↕	↕	↕
Modality	Interpretive scheme	Facility	Norm
	↕	↕	↕
Interaction	Communication	Power	Sanction

Fig. 3. Dimensions of the duality of structure

4 Data Analysis by Means of Structuration Theory

4.1 Data Collected During Site Visits

Between April 2013 and October 2016, seven research visits and three technical visits were made to Mafarafara. Research visits lasted 3-5 days each, and consisted of a team of two to four CSIR researchers who collected data while they engaged with the ERW. The first visit was to assess the ERW's livelihood and information needs. During the second visit, the ICT artefact was installed and training commenced. The subsequent visits were used to provide refresher training and to assess the ERW's use of the ICT artefact. In addition, the research team tried to find out about further information needs of the ERW and whether any modifications were required to the ICT artefact. The technical visits were done between research visits to make changes or updates to the ICT artefact. The seventh and last research visit took place in October 2016. This visit was to assess the damage that a storm had caused the building housing the ICT artefact. After visit 7 the project was put on hold as the ICT artefact could not be further supported until a new suitable venue was arranged. This remained the status at the time of writing. All seven research visits were accompanied by data collection by means of interviews and/or focus group discussions, as well as site visit reports and these were used for the data analysis.

4.2 Social Structuration Account of the Co-creation Process

Below is a demonstration of the social structuration processes that accompanied the co-creation of the ICT artefact, as undertaken by the CSIR research team and the ERW of Mafarafara. To illustrate how the data was presented and analysed, the analysis will be shown that was done for visit 1 (**Table 1**) and visit 5 (**Table 2**).

Table 1. Data analysis for Visit 1

Activity	**Signification**	**Domination**	**Legitimation**
Arrival at Mafarafara			Mma C receives and hosts CSIR group (mutual sanctioning)
	Mma C declares she is not clear on purpose of visit (problem of signification)		
Day 2: Visit to chief			Obtains chief's blessing on project (normative requirement of traditional culture)
First meeting with ERW	Introductions made between research team and ERW (sense-making ritual)		
	ERW struggle to understand what ICT artefact will be like. An attempt is made to answer sense-making questions asked by ERW		CSIR team explains ethical consent process (normative requirement of research community). Informed consent forms signed
Day 3: Visit to crop fields	CSIR team taken to see crop fields for themselves (sense-making by research team)	Crop fields: community's allocative resource. Only partially usable because lack of irrigation	
Second meeting with ERW	Information gathered on women's livelihoods, previous exposure to technology and information needs related to farming		Ethics clearance process with new attendees. ERW conditionally accept the project
Technical site inspection visit	Assessment of physical site to prepare for technology installation (ICT artefact and solar panels)		

The first visit consisted mostly of sense-making activities. Mutual sense-making had to take place to prepare both groups (ERW and research team) for further interaction and the installation that was to follow. In addition, social structures of legitimation were acknowledged and adhered to. These included the recognition of the tribal chief and paying him a visit of respect. From the CSIR's side, their research ethics required them to ensure that all participants understood the informed consent process and forms. Lengthy conversations were required before all participating ERWs were at ease with the consent forms they had to sign.

Table 2. Data analysis for Visit 5

Activity	**Signification**	**Domination**	**Legitimation**
Debriefing: Unhappiness expressed about home interviews during visit 4			The CSIR male researcher broke a social norm by interviewing the women privately at their homes
Further feedback interviews	To most participants, the use of the ICT artefact has become a regular social ritual that gave meaning to their daily existence	ERW more confident using the ICT artefact. Their ability to use it has boosted their self-esteem and gives them social power in the community	
ERW made aware that they will have to take over maintenance of the ICT artefact	While ERW confirm this, they are still not clear how they will do it.		

Visit 5 constituted another follow-up visit to find out how the ERW were experiencing and using the ICT artefact, and what further improvements or modifications were required. As the process of co-creation was applied as explained by Suryana, Mayangsari and Novani [25], the ERWs could during the research visits provide inputs to co-create the ICT artefact based on their needs in order to gain value. They *co-experienced, co-defined and co-developed*.

A social surprise awaited the CSIR team. During the previous visit, a male researcher did feedback interviews with the women who used the ICT artefact. Mma C suggested that he spoke to them individually and privately so that they could speak more openly. Times and venues were agreed upon: he agreed with the women to interview them at their homes. None of the interviewees objected to the venues, and 11 interviews were conducted. It appeared that the women's husbands were unhappy when they found out afterwards, and the moral blame was shifted to the researcher. In hindsight, it is easy to say that the researcher should never have conducted the interviews at their homes. However, at the time it seemed the obvious thing to do. For the sake of the social relationship, the male researcher was withdrawn from the project even though he was a valued researcher. The fact that the women were reprimanded for interviews with a male researcher shows their lack of social power in the patriarch community.

Concerning the use of the ICT artefact: it became part of the daily lives of the participants:

"In the morning we first pray and then the [ICT artefact] is switched on. We then log in… and start playing games or looking at our personal files… Some days, we log in for a while and then go and work in the garden." (Mma MM)

"The day starts with having to clean the room and the [ICT artefact]. [We] then log in and participate in the different offerings. When tired, it's time to give others a chance. [We] help each other during the process…. Others [are] sewing clothes…. Others sew reed mats and traditional outfits…" (Mma C)

"It's like work, I'm there every day" (Mma FM)

The women's descriptions of their daily activities show that they visited the community centre on a daily basis, and took turns to work on the ICT artefact and do craft activities like weaving and sewing. The women assisted each other as some of the illiterate older women required help in typing their names. As can be seen, the use of the ICT artefact became a regular social practice at this stage.

Benefits that the ERW derived from the co-created ICT artefact.

The analysis of interview data and site visit reports showed that the women experienced a variety of benefits from using the ICT artefact, such as improving their computer literacy and finding value from the information they could search. It also showed some unexpected benefits. One of these was the immense pride that the illiterate ERW took in being able to type their name (their username to log in was their own name). One woman stated that using the ICT artefact gave her the confidence to use an ATM for the first time – prior to this she needed to take someone along with her to do her ATM banking. These are examples of empowerment within the ERW's particular social context, as it improved their capabilities as well as their self-esteem.

This intervention supports literature [24, 38, 39] that underlines the importance of applying ICT in a specific context to the benefit of a community and taking into account their needs. A natural disaster ended this study and not the fact that the deployed ICT did not support the community to empower them and to improve their lives.

4.3 Discussion

With the application of structuration theory, it is shown how the social structures of signification (sense-making or understanding), domination (use of allocative and authoritative resources to exercise social power) and legitimation (application of social values or norms) influence the execution of the project, of which the aim is to improve the design of the ICT artefact for use by the ERW. It is also shown how the use of the ICT artefact by the ERW became a regular social practice, and hence integrated in their daily rituals. The benefits they derived show some evidence of social empowerment.

5 Conclusion

The aim of the Mafarafara ICT4D project was to support ERW from a disadvantaged community by means of a co-created ICT artefact that would enable and support their livelihood activities. A DSR methodology was employed to refine an ICT artefact based on Digital Doorway technology. The ERW were continually involved in assessing the usefulness of the ICT artefact and suggesting improvements, to the extent that they were co-creators of the artefact.

In a social setting such as Mafarafara, the understanding of the social dynamics accompanying an ICT4D project is essential to the project's success. To this end, structuration theory was used to make visible the social dynamics accompanying the design and implementation process. It was demonstrated how structuration theory contributed to understand the drivers of project success, as well as areas of potential misunderstanding. It was further shown that the ERW gained social agency through the use of the ICT artefact, which is a form of empowerment.

This study was limited to a single case setting, namely the Mafarafara community in South Africa. However it is part of a larger family of Digital Doorway projects from which mutual learning takes place. A suggestion for future research is to repeat the study with other ERW in a different cultural setting and compare the results, in order to develop a better understanding of ERW as a user and participant group.

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